

15th SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)  
Hitchhiking to the Moon (8)

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INTRODUCING MINAS ITHIL: AN ITALIAN MICRO AND NANOSATELLITES MISSION TO THE  
MOON

**Abstract**

The paper describes the mission concept and pre-feasibility results of an Italian Space Agency lunar mission based on micro and nanosatellites. The main objective of MINAS ITHIL (MICro and NANosatel-  
lites System for Interplanetary Transfer and Hyperspectral Imaging of the Lunar surface) is to facilitate the Italian access to the Moon and to be precursor to future missions. This objective will be pursued by means of the realisation of a time and cost effective End-to-End interplanetary programme, addressing all the architectural and operative aspects, from the design and manufacturing to the launch and till the operations phase. The flight unit will consist of:

- a microsatellite as a multipurpose transfer vehicle (called TAXI, Transfer vehicle for Apogee-kick and eXtraterrestrial orbit Insertion);
- 1 or 2 nanosatellites (called LUNA, LUNar NANosatellite) which will be inserted into selenocentric orbit and shall carry on board an observation payload.

The launch scenario is constrained by both the low total mass (thus low  $\Delta V$ ) and the low-cost approach. From this point of view, the preliminary study showed that it is possible to launch the flight unit in GTO as an Ariane 5 "mini"-class piggyback payload. From GTO the TAXI module will have the propellant sufficient to perform a direct transfer to the Moon and the insertion into selenocentric orbit. TAXI has been preliminarily studied in the Italian Space Agency "Concurrent Engineering Facility", so that the spacecraft initial configuration and budgets have been assessed. So far, the LUNA nanosatellites have been less detailed than TAXI. Nevertheless, from the preliminary study, it turns out that the payload which can be embarked on them, though small (due to mass, power and environmental constraints), is still suitable for reaching the technological and divulgatory mission objectives. According to that the present assumption is to have a "hyperspectral" payload, considered in a broad sense (an optical camera will be placed on board one of the LUNA and a camera or spectrograph sensitive in a scientifically interesting

band on the other satellite). The paper deals with the overall mission concept description, the system analysis and budgets and the relevant programmatic (time, costs and risks) aspects. The sub-system level pre-feasibility study and the future developments are also reported.